	Office of Safety Regulation of the TWRS-P Contractor Richland Operation Office, P.O. Box 550, MS A4-70, Richland, WA 99352 Phone (509) 376-4132 Fax (509) 376-3661	**Regulatory Unit**

Meeting Record

IMS:

MEETING PURPOSE:	RU/BNFL Topical Meeting to discuss the TWRS-P Electrical Design
MEETING DATE/TIME:	February 29, 2000 /1:00 – 5:00 PM
MEETING PLACE:	Room 53, Federal Building, Richland, WA
AGENDA:	1. RU Opening Remarks 2. BNFL discussion of Electrical Design
ATTENDEES:	See Attachment 1
PREPARED BY:	Ko Chen
CONCURRENCE:	George Kalman

KEY DISCUSSION ITEMS:

The meeting began with a welcome from the RU, the introduction of attendees (Attachment 1) and a review of the meeting agenda. The RU then briefly went over the transition issues since the November topical meeting. The transition issues included the following:

- The January 2000 topical meeting was held on January 25, 2000 and the meeting minutes were issued on February 15, 2000. BNFL concurred with the minutes without comments.
- The BNFL review comments of the October 1999 topical meeting minutes were issued on November 29, 1999. RU accepted the comments into the meeting record.
- The BNFL review comments of the November 1999 topical meeting minutes were issued on January 24, 2000. RU accepted the comments into the meeting record.
- A preliminary BNFL submittal for the February topical meeting was received by the RU on January 26, 2000.
- A level 1 meeting in preparation for the February 2000 topical meeting was held between the RU and BNFL on February 1, 2000.
- A revised BNFL topical meeting submittal was received by the RU on February 15, 2000.
- The RU and BNFL held a follow-up meeting to discuss the BNFL risk goals on February 10, 2000. The RU stated that it is working on a position paper to further delineate its

position on risk goals. The paper is intended to simplify the process for the risk goal calculation by BNFL. The paper is expected to be completed in March and will be available for BNFL review. The RU also stated that it has not evaluated the reliability data of emergency diesel generators (EDG) provided by BNFL in the January topical meeting submittal and will do so in the future.

Status of ISA Open Issues and Questions

Sixteen of the 133 original ISA open issues and questions remain open. The sixteen open issues and questions include:

Q. 102, Q. 31, Q. 92, A2, A3, A8, A9, A15, A18, C30, D10, D11, D12, D13, D14, D15

Status of Topical Meeting Action Items

As identified in the BNFL letter, dated February 15, 2000, 18 action items remain open. Two more action items were generated during the January 2000 topical meeting. A total of 20 action items remain open.

The BNFL Review Comments on the October 1999 Topical Meeting Minutes

The RU accepted the following clarifications from BNFL:

- Page 3, first bullet, revise the second sentence as follows: “The vessel is now located approximately at the center of the Pretreatment Building.”
- Page 3, fourth bullet and third sentences, revise as follows: “A new airborne release fraction (ARF), 1.7E-5, is used instead of the bounding value (2.0E-3) from the Department of Energy (DOE) handbook, DOE-HDBK-3010----- BNFL emphasized that the new ARF was derived from measurements based on test conditions similar to those of the Tank Waste Remediation System-Privatization (TWRS-P) facility.”
- Page 3, revise the first sentence of the last bullet as follows: “The Cs-137 content used for dose calculations, 13 M Ci, is derived from the contract maximum ratio of 2.0E+10 Bequerels Cs-137 per mole sodium, multiplied by the sodium inventory from the Best Basis Inventory.”
- Page 4, first bullet, revise as follows: “The vessel heat-up calculation following loss of cooling includes heat release to the environment.”
- Page 4, second full paragraph, revise “agreement” to assessment”.
- Page 6, third full paragraph under “Control Strategy Development for Cs Storage Vessel Heating”, revise second sentence to “The BNFL assessment concluded that all three options can achieve a reliability of <10E-4 per year.”
- Page 7, under the heading of Seismic Probabilistic Risk Analysis for the RPP-WTP, revise the first bullet as follows: “To demonstrate conformance with radiation exposure

standards, the seismic PRA will use an iterative, bounding analysis."

- Page 7, second full paragraph, revise 10E-6 to 1.0E-6.
- Page 7, item 1, revise the first sentence as follows: "Estimating the fragility parameters for SSCs: median capacity and variability."
- Page 8, item 6, revise "radiation exposure limits" to "radiation exposure standards".
- Page 8, item 7, revise the second sentence to read: "Once these critical SSCs are identified, more realistic fragility parameters (higher damage state) may be developed or further strengthening of seismic design for these SSCs may be considered."
- Page 8, item 9, revise the sentence to read: "Iterate the process (from step 6) until compliance with TWRS-P radiation exposure standards is demonstrated."
- Page 8, second bullet, revise the last sentence to read: "BNFL will re-evaluate the PRA work when the design of the facility is finalized."

The BNFL Review Comments on the November 1999 Topical Meeting Minutes

The RU accepted the following clarifications form BNFL:

- Page 5, second set of bullets, fifth bullet, revise to read: "Were all Severity Level 1 accidents defined as potential DBEs? Yes."
- Page 5, second set of bullets, seventh bullet, revise to read: "BNFL stated most estimates of initiating frequencies and consequences results were made qualitatively based on engineering judgements in Cycle 1. *However, estimates will be quantitative in Cycle 2, when this is required."*
- Page 5, second set of bullets, eighth bullet, revise to read: "BNFL states cost/benefit is one of the control strategy selection criteria. Was there any dollar amount associated with dose prevention for any control strategy? BNFL pointed out that the analysis has not matured to the point where cost/benefit analysis can be performed."
- Page 10, second set of bullets, fifth bullet, clarify as follows: "Chemical hazards were addressed in Cycle 1 when they were the initiators of radiological release. It was pointed out that chemical hazards are being treated on an individual basis, when identified in Cycle 1. Chemical hazards are to be addressed in the April 2000 topical meeting."

The BNFL Review Comments on the January 2000 Topical Meeting Minutes

BNFL accepted the January 2000 topical meeting minutes without comments.

BNFL Presentation

After this introduction by the RU, the BNFL portion of the program began. The focus of the meeting was to discuss BNFL's electrical design. This included an overview (Attachment 2), electrical system design standards (Attachment 3), and BNFL's electrical system design (Attachment 4).

Overview of the TWRS-P Electrical Design

BNFL stated that the primary objective of this topical meeting was to describe the portion of the electrical power distribution system that is associated with important to safety (ITS) systems, structures, and components (SSCs) and describe the manner in which common mode/common cause events are accommodated, including fires and seismic events. The ITS electrical power requirements were classified as safety design class (SDC) and safety design significant (SDS). The definition of SDC and SDS was described in Safety Criterion 1.0-8, volume 2 of the BNFL Safety Requirements Document (SRD). The seismic category (SC) for SSCs was defined in Safety Criterion 4.1-3 and 4.1-4 of the SRD. As currently envisioned, the safety requirements, SC, ITS designations, and major electrical equipment requirements of different operating systems for the pretreatment facility, the low activity waste (LAW) facility, and the high level waste (HLW) facility are tabulated in Attachment 2. The RU commented that the basis for these classifications was not provided in the topical meeting submittal. Therefore, the RU has not reviewed nor accepted them.

BNFL stated its configuration of the electrical system is driven by a loss of off-site power (LOSP) design basis event (DBE). The BNFL Cycle 1 hazard analysis process identified this event to be a LOSP induced failure of the vessel vent and purge system in the pretreatment facility. BNFL concluded that this event could initiate a build-up of hydrogen in tanks and pipes and in 32 hours, hydrogen could reach a detonable level in at least one vessel. BNFL concluded that this event is severity level 1 (SL 1) for workers, co-located workers, and the public. SL1 events were defined by BNFL as extremely unlikely events with consequences exceeding the radiological standards (>25 rem/event for facility and co-located workers, and >5 rem/event for the public). BNFL noted that any accident with severity level 1 (SL1) consequence should have a target frequency of less than 1.0E-6/year to meet SRD Volume 2, Appendices A and B criteria. Based on its evaluation, BNFL stated this requirement can be met by three independent safety buses, each backed by identical emergency diesel generators (EDGs).

The following are exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- Will estimates on frequency and consequence from Cycle 1 process be updated in Cycle 2? Yes, they will be updated after the completion of Cycle 2.
- Are all SDS SSCs assigned as SC III? This preliminary evaluation indicated that this is the case.
- Has BNFL looked into fire accidents, initiated by seismic events? BNFL has not evaluated those accidents and thus has not identified any requirements in that area.
- Why isn't the C5 extract system assigned as SC I? In the event of seismic events, the safety is provided by building structures, not C5. Therefore, the building structure is assigned as SC I, not C5 system.

- Does NOx hazard stop after earthquake event? Cycle 1 process has not evaluated this issue.
- Why are EDGs required to start in 10 seconds? BNFL noted that its EDGs are required to start in 10 seconds because the off-gas system of LAW melter will cease operating in the event of a LOSP. The off-gas system maintains the melter at a negative pressure. Melter off-gas including NOx could be released into potentially occupied areas if the negative pressure is lost. Therefore, to protect workers, the melter off-gas system must remain operating whenever the melter is evolving NOx.
- What is the basis of 32 hours for the hydrogen build-up? The basis for this number was discussed in the September 1999 and the January 2000 topical meetings.
- What is the reliability of the uninterruptible power system (UPS)? The UPS is backed up by EDGs. The reliability of BNFL's EDG is comparable to those operating in nuclear power plants.
- Are all systems containing radioactive material assigned as SDC? No.
- What is expected to function following a DBE seismic event? BNFL has not defined these requirements.

Electrical System Design Standards for RPP-WTP

BNFL stated the objective of its electrical system design presentation was to:

- Show that environmental qualification is not applicable.
- Propose a change to the SRD to clarify application of environmental qualification requirements.
- Propose replacement of Institute of Electrical and Electronic Engineers (IEEE) Standard 387 with National Fire Protection Association (NFPA) Standard 110 for EDGs.

BNFL stated the current electrical design standards cited by the SRD include IEEE standards 308, 323, 338, 344, 379, 382, 384, 387, 603, 628, 741. Attachment 3 lists additional IEEE standards not referenced in the SRD, but cited as references within SRD referenced IEEE standards. BNFL stated the purpose of environmental qualification testing for Class 1E equipment is to demonstrate that the equipment can perform its safety functions throughout its qualified design life while subjected to postulated service conditions. BNFL noted that the requirement for equipment environmental qualification is defined in Safety Criterion 4.4-2 of the SRD. The implementing codes and standards for that criterion are IEEE 323 and 10CFR 50.49. The mild environment for environmental qualification testing is defined by both IEEE 323 and 10 CFR 50.49. The harsh environment for environmental qualification testing was defined in IEEE 323. In the presentation, BNFL cited several examples to show that its electrical equipment is not expected to operate in the harsh environment as defined in IEEE 323. BNFL proposed to modify Safety Criterion 4.4-2 of the SRD to state that only SDC SSCs located in harsh environments shall be subject to environmental qualification. The RU noted that Safety Criterion 4.4-2 is a restatement of DOE top-level standards and as such, revising it is not appropriate.

BNFL provided a list of recommendations for application of IEEE Class 1E standards, which includes tailoring and replacement of current standards in the SRD. In summary, BNFL stated IEEE Class 1 E standards providing design criteria will be tailored to suit the vitrification facility application. BNFL has not identified instances of equipment operating in a harsh environment. Consequently, IEEE Class 1E standards providing environmental qualification requirements may not be applicable.

The following are the exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- The RU commented that a more appropriate way to deal with the environmental qualification requirement is to tailor standards instead of modifying a SRD safety criterion. BNFL observed that environmental qualification requirements increase equipment cost substantially.
- Has BNFL made detailed comparisons between NFPA 110 and IEEE 387 concerning EDGs? BNFL has made the comparisons. BNFL stated that both standards are very similar except for environment qualification requirements, which NFPA does not have.
- The RU commented that IEEE 387 and NFPA 110 standards are intended to be applicable in different environments (387 for nuclear power plants and NFPA for commercial buildings). BNFL responded that since RPP-WTP is not a nuclear reactor facility, it feels that NPFA is suitable for its facility.
- Will the authorization basis amendment request (ABAR) process be used to tailor standards as proposed by BNFL? Yes. The ABAR on electrical standards will be completed by April for the RU review.
- How many of the SRD electrical standards require ABARs? Ten of 11 standards need to be revised.

<u>The BNFL Electrical System Design</u>

The BNFL electrical system design consisted of the following:

- Four 13.8 kV Feeds from DOE 230kV Substation.
- Four 13.8 kV Power Buses; two Load Group A and two Load Group B.
- Two 4.16 kV Normal Power Buses; Load Group A and Load Group B.
- Two 13.8 Kv Standby Power Buses.
- Three 13.8 Kv Standby Diesel Generators.
- Three independent 4.16 Kv Power Buses (A, B, and C) for emergency power system and three independent onsite emergency diesel generators.

The diesel generators proposed by BNFL will have the following characteristics:

- Three independent self-contained diesel generator sets.

- 2000KW each.
- Design per IEEE 387 or NFPA 110.
- Seismic qualification per IEEE 344.
- Seven days supply of fuel oil per IEEE 308.
- 10 seconds load acquisition.

During the meeting, BNFL also presented the schematic drawings for the following: site plot plan, ITS switchgear building, switchgear building, duct bank routing, HLW load center, UPS, ITS motor control center for HLW and Pretreatment building. The drawings are included in Attachment 4.

The following are the exchanges between the RU and BNFL on the subject with the RU comments or questions followed by the BNFL response:

- Will load sequencing be a part of the electrical system design? No, all emergency loads will be loaded initially onto the EDGs.
- How is power distributed from diesel generators to the load buses? By dedicated conduit.
- Are all fire walls in buildings made of reinforced concrete? Yes.
- Why does BNFL require 3 diesel generators, each with 2000 KW power? The current load evaluation indicates that this much power is required to maintain the off-gas system for the three LAW melters in operation whenever the LAW melters are evolving gas, and to maintain ITS instrumentation and control equipment. However, there is a possibility of reducing the power requirement when additional evaluations are performed.
- Are all electrical bus cross-connects automatic? Yes. This can also be done manually.
- Will EDGs be procured in natural phenomena hazard protecting containers? Yes.
- Is ventilation required for EDGs within containers? Yes, the EDGs and containers are a complete package.
- Why is there only one fuel tank with 7 days supply of fuel oil on the site for 3 diesel generators? For the 32 hours hydrogen explosion design basis event, three diesel generators decrease the probability of diesel failure to less than 1.0E-6/year. However, only one diesel generator is required to provide emergency power for sufficient tank ventilation to prevent hydrogen explosion. Therefore, only one fuel tank with 7 days supply of fuel oil is required.
- Is the electrical system designed to accommodate an expanded LAW melter design? No.

Action Items

1. RU will provide BNFL with a schedule for review of the BNFL conclusion that the likelihood of a facility blackout is less than 1.0E-6/year based on its current electrical system configuration.
2. BNFL will provide the RU with the basis for the safety classifications of SSCs (ITS designations, seismic category etc.) as tabulated in the topical meeting submittal.

INFORMATION EXCHANGED:

1. The RU meeting presentation material
2. BNFL handout on electrical system design overview
3. BNFL handout on electrical system design standards
4. BNFL handout on electrical system design

ATTACHMENTS:

1. Attendance list
2. BNFL handout on electrical system design overview
3. BNFL handout on electrical system design overview
4. BNFL handout on electrical system design standards